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# Fuel Efficient Incineration for Disposal of Sewage Sludge

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# FUEL EFFICIENT INCINERATION FOR DISPOSAL OF SEWAGE SLUDGE

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16. ABSTRACT

The City of Indianapolis, Indiana, demonstrated that 34 to 70 percent of the fuel used for sewage sludge incineration could be saved. These savings were the result of study of how sewage sludge incineration in a multiple hearth incinerator works, adding instrumentation and controls to the furnace system and training the operators in the technical aspects of sludge incineration. This program saved Indianapolis about $1,000,000 in fuel and maintenance repairs.

This Fuel Efficient Mode of Operation also reduced the air pollution from sewage sludge incineration and allowed the City to cancel a $3,000,000 construction program for air pollution abatement equipment for sewage sludge incinerators.

Other cities--Nashville, Tennessee; Hartford, Connecticut; and Buffalo, New York--have also adopted the fuel efficient mode of operation and realize a savings caused by 40 to 50% less fuel usage for sewage sludge incineration.

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# FUEL EFFICIENT INCINERATION FOR DISPOSAL OF SEWAGE SLUDGE

About $1,000,000 a year in fuel costs are saved by the City of Indianapolis, IN, as a result of a demonstration project partly sponsored by the U. S. EPA Wastewater Research Division, Municipal Environmental Research Laboratory (MERL) at Cincinnati, in cooperation with the Indianapolis Center for Advanced Research (ICFAR). Another $3,000,000 one time savings were realized when Indianapolis was able to cancel plans for construction of new air pollution control equipment because the demonstration brought the incinerators into compliance with air pollution regulations. All this was accomplished by installing $250,000 worth of instrumentation and equipment and greatly improving the incinerator operating methods by what is now known as the "fuel efficient mode of operation." The fuel-efficient mode is essentially a partnership of sound engineering and good operation. It first requires installation of adequate instrumentation to control excess air and temperature profile. Computer analysis defines the optimum operating conditions for the site. Operators are trained to use the results of the analysis and are sensitized to sources of energy loss such as high moisture feed, air leaks, and excessive exhaust gas temperature. If the 350 municipalities that operate incinerators for sewage sludge disposal would improve their incinerator operating methods and burn sludge more efficiently as was done at Indianapolis, the taxpayers might save as much as $120,000,000 per year for fuel alone. The improved operating control frequently results in reductions in maintenance and other operational costs about equivalent to the savings in fuel costs.

Over 25 billion gallons of domestic and industrial wastes are discharged daily into the nation's municipal sewers. Treatment of these wastes results in the annual production of nearly seven million dry tons of raw sludge which must be disposed in an environmentally safe manner. Currently, about 22 percent of this sludge is incinerated.

Incineration is a disposal option that provides an inert, safe residue of minimum volume. The use of this option is expected to increase as landfill sites become less available and as ocean disposal is phased out.

One of the biggest problems facing municipalities that operate sludge incinerators is the high cost of energy that is needed both for the actual incineration process and for air pollution control. A recent survey shows that approximately 15 to 20 percent of the sludge incinerators constructed since 1970 are no longer in operation due to high operating costs for energy. About 80 gallons of fuel oil are required to burn one ton of dry solids.

As a result of a demonstration project at the City of Indianapolis, it was determined that the fuel consumption for burning sludge could be reduced 34 to 70 percent in the eight multiple hearth incinerators by improving existing instrumentation and control systems using a more fuel efficient operational mode, and providing operator training to give them a better idea of how the incinerators work to burn sludge. Costs for upgrading instrumentation and control systems and for operator training were about $20,000 per incinerator. Based on an oil price of $1.00 per gallon, this $20,000 had a payback period of less than three months due to the reduction in fuel use.

An equally important finding was the reduction in particulate emissions that occurred when the incinerators were operated in the fuel efficient mode. The incinerators were formerly emitting particulates at up to four times the allowable standards. These incinerators were brought into compliance with the air emission standards and normally operate at less than 30 percent of

the compliance particulate emission allowance. This enabled the City to cancel a $3,000,000 planned construction program for new air pollution abatement equipment to bring the incinerators into compliance.

Additional savings were realized for maintenance and repairs to the furnaces as well as reduction in utility costs. There were not statistical records kept of these costs, but there is an awareness that the costs are less than experienced before the fuel efficient operation was initiated.

The fuel used nationally for incineration of sewage sludge in 1980 was equivalent to 120 million gallons of oil. It has been projected that this will increase to 160 million gallons in 1985, and that the cost of the oil will increase from $1.00 per gallon to $1.50 per gallon. Most municipal sludge incinerator operations are still experiencing high fuel consumption rates as a result of using improper incinerator operating modes. Fuel efficient incinerating methods could save 50 percent or more of this fuel in 1985 or 80 million gallons per year, costing $120 million.

Indianapolis is not the only city to experience these savings resulting from improved instrumentation and fuel efficient operation. Wastewater treatment plants in Nashville, TN, Hartford, CT, and Buffalo, NY, working with the ICFAR, which did the work for Indianapolis, have adopted this mode in their plants. Even though these were relatively modern plants with most of the necessary instrumentation and control systems installed, fuel savings were still large. Payback periods were even shorter than at Indianapolis because capital expenditures for new equipment were less.

The Nashville Central Wastewater Treatment Plant at Nashville-Davison County, TN, realized about 40 percent fuel reduction, saved $350,000 a year for fuel costs and also experienced reduced operating and maintenance costs after initiating the fuel-efficient operating mode program. They can save still more if more instrumentation and controls are installed.

The Hartford Metropolitan District Commission, CT, has reduced its fuel usage 83%. Their fuel consumption was 125 gallons per dry ton in 1978. This was reduced to 43.5 gallons per dry ton by using belt press filters for dewatering. In 1982 consumption was reduced to 21.1 gallons per ton by improved instrumentation coupled with operation at optimum conditions. Excluding their nonproductive operations (warm-up during the weekend), their fuel usage averages substantially less than 12 gallons a dry ton. The Hartford plant often burns sludge without using fuel. When present and 1979 costs are compared, Hartford now saves $1,300,000 annually on operations, $1,076,000 for fuel, and $224,000 for maintenance and utility costs. At Hartford, savings were proportionately greater than at Indianapolis because the dewatering device was changed, producing a much drier feed to the incinerator. No credit has been taken for improvements in air emission resulting from use of less excess air.

Buffalo, NY, a new facility, has reduced their fuel usage from 90.9 gal/dry ton to 48 gal/dry ton using the fuel efficient mode of operation. This was a 47 percent reduction from design expectations. The plant had only run for short periods of time before the fuel efficient mode of operation was initiated so no dollar savings can be determined.

Reports on Indianapolis, Nashville, and Hartford which give full details are being processed for release. The Hartford work was also described in a paper presented at the U. S. EPA International Conference on Thermal Conversion of Municipal Sludge, March 21-24, 1983, Hartford.

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